MV 4204 Computer Graphics using X3D/VRML (4-0)

Synopsis An introduction to the principles of hardware and software used in the production of computer-generated images. Focus of the course is design projects using X3D/VRML.

Instructor Don Brutzman Root 200 1.831.656.2149, home 1.831.372.0190
brutzman@nps.navy.mil *http://web.nps.navy.mil/~brutzman*

Office hours are anytime you find me there. Usually I am available as indicated by the schedule posted outside my office. Make an appointment if you want to be sure to see me. If necessary you may call me at home (earlier than 2200 please).

Schedule Monday through Thursday 1000-1050, Halligan 123. Exams are project demos. Spanagel 256 Graphics Lab and Root 228 lab are normally available for your use.

Curtis Blais and Jeff Weekley will instruct during some of my travel days.
No class held during holidays, SIGGRAPH conference or MOVES Open House.

July 8-10	DMSO Componentization Workshop, Arlington VA.
July 19-26	SIGGRAPH, San Antonio http://www.siggraph.org/s2001
August 19-22	MOVES Open House http://www.MovesInstitute.org
September 5-11	XMSF Symposium DC, SIW Orlando. http://www.sisostds.org

Software X3D-Edit authoring tool. Free. We will use online examples matching the textbook.
http://www.web3d.org/TaskGroups/x3d/translation/README.X3D-Edit.html
http://www.web3d.org/TaskGroups/x3d/translation/examples/contents.html
http://www.web3d.org/TaskGroups/x3d/translation/examples/Vrml2.0Sourcebook/contents.html

Textbook 1. Ames, Andrea L., Nadeau, David R. and Moreland, John L., *VRML 2.0 Sourcebook*, second edition, John Wiley and Sons Inc., New York, 1997.

Optional texts 2. Hartman, Jed and Wernecke, Josie, *The VRML 2.0 Handbook: Building Moving Worlds on the Web*, Addison-Wesley Publishing Co., Reading Massachusetts, 1996.
3. Lea, Rodger, Kouichi Matsuda and Miyashita, Ken, *Java for 3D and VRML Worlds*, New Riders Publishing, Indianapolis Indiana, 1996.

No other textbooks are required for successful completion of this course.
There are numerous online references available on the course home page at
http://web.nps.navy.mil/~brutzman/vrml

Guidelines

1. You must devote time to reading and programming to succeed in this course.
2. Students are encouraged to study together. However every assignment submitted must be your own work. Group solutions to project assignments are only acceptable when specified. As in any endeavor your individual integrity is essential. If in doubt, ask.
3. I am designing this course to significantly help you in your thesis and other courses. Your comments, questions and suggestions are always welcome.

Course Objectives

1. Gain a broad view of 3D computer graphics

2. Learn to properly design and structure VRML 97 scene graphs

3. Learn Extensible 3D (X3D) scene graphs and rudimentary XML

4. Extend your programming skills using animation techniques, scripts and routes

5. Support thesis work and projects in other classes

6. Use online tutorials and public-domain software

7. Provide tools, techniques and a repeatable methodology that you can use later

Class Policy and Study Recommendations

1. You are learning new ideas and a new language. Thinking and writing in a new language requires fluency. Don't be reluctant to think new thoughts or work hard. Persistence pays.

2. You will get a LOT more out of class by reading assigned material beforehand. Keep ahead of me in your reading. Read each section at least twice. This is a challenging and ambitious course that is well worth your while.

3. Discussion and dialog will make class a lot more immediate.

4. Projects make up your entire grade, just like the real world. Exams are boring.

5. Grading is based on merit and performance. I expect everyone to work hard and get an A.

6. You learn how to program solutions to problems by doing. Thus lots of projects. Each weekly project (or projects, if you prefer) should incorporate and demonstrate the use of VRML nodes we are studying. Your final project should pass the Aquantitatively cool@ test.

7. Students are expected to hand in projects on time. It is your responsibility to contact me in advance for assistance if you are unable to meet an assignment date. I prefer that you hand in something late which is correct, rather than something on time which is broken. Don't get behind, we will follow a fast pace!

8. You must provide an electronic mail address so that I can send messages to the entire class. Numerous online references will be provided that you will need to retrieve. I recommend that you have an NPS home page that serves 3D content as part of this course.

9. I recommend that you subscribe to Web3D Consortium working groups www-vrml mail list via http://www.web3d.org/www-vrml

MV 4204 Computer Graphics using X3D/VRML

Week	Chapter		Assignment	Example scenes weekly
1 July 8-11	1, 2, 3, 4	Intro, key concepts, shapes & groups, Text	Install/run X3D-Edit	
2 July 15-18	5, 6, 7, 29	Transform: translate rotate and scaling, WorldInfo and header/metadata conventions	Discuss projects	
3 July 22-25	review	SIGGRAPH Symposium	no instructor	
4 July 29 – August 1	26, 8, 9	Viewpoint control, Interpolator animation, sensing viewer		
5 August 5-8	10, 11, 12, 28, 13	Materials, Grouping, Inlines, Anchors, Points/lines/faces		
6 August 12-15	14, 15	Elevation grids, Extrusions		Midterm demos
7 August 19-22	22	Background and Universal Media panoramas		MOVES Open House
8 August 26-29	16, 17, 18	binding Colors, mapping Textures	Final project plans	
9 September 2-5	20, 19, 21	Lighting, Normals & shading, shiny Materials		
10 September 9-12	23-25, 27	Fog, Sound, Level of Detail, Proximity sensing	Curt Blais instructor	
11 September 16-19	30, 31	Scripts, Prototypes, advanced topics		
12 September 23-26	-	Finals week: class project	Coolness!	Final demos

MV 4204 Computer Graphics using X3D/VRML - Class Projects

Your grade will be based on various individual programming projects, contributions to the class project and a final report. Some will be individual projects, some will be a group effort.

Graded projects weighting:

- 10 weekly projects at 5% each. Demonstrate use of nodes in current chapters of study.
- 1 mid-term demo at 20%. Demonstrate cool reworkings of kelp-forest content in X3D, plus some new contributions to the models.
- 1 final project at 30%. New models for the kelp forest, for the periscope-trainer models library, or on a previously agreed-upon project (such as thesis work).

Here are final project and report attributes:

- Group approach, or individually designed & executed. We have several interesting ongoing projects that can benefit from improvements and extensions.
- Best approach is work related to your thesis, if possible. Think of this as a prototype.
- Topic mutually agreed upon
- Project outline and methodology proposal, updates due as scheduled
- Deliverables:
    - minimum five pages of text in report (I prefer that you write a draft thesis chapter)
    - at least five references from text bibliography included and evaluated
    - abstract, table of contents, problem statement & solutions, screen snapshots
    - appendices: software source code, user guide, session log
    - provide HTML page and links to source code to remain online
- 10 minute presentation / demonstration to class during exam week

Candidate Projects

- Kelp Forest! http://web.nps.navy.mil/~brutzman/kelp
- Ships, aircraft, vehicles. Help populate periscope training, submarine collision and amphibious invasion projects. http://web.nps.navy.mil/~brutzman/Savage
- Autonomous underwater vehicle (AUV) dive site, telemetry playback, sonar visualization
- NPS Beach lab facility: real estate, buildings, tanks, photo textures
- NPS campus with terrain, water features, simple buildings (e.g. Hermann or Spanagel Halls)
- MBARI's remote operated vehicle *Ventana* and cold-seep dive site
- What is your challenge of interest? Let's discuss it.

Advanced Ten Foot Tall Projects

- DIS-Java-VRML humanoids, electronic emission entities
- SOSUS sonar array, beach facility, lighthouse and terrain at Point Sur
- Scientific visualization of sonar beams
- Spanagel Hall graphics lab, CAVE, video labs
- GeoVRML terrain textures, modeling for Monterey Bay or Fort Irwin terrain datasetsJava3D-X3D-VRML interoperability: open-source software, NPS cave, etc.
- Autogeneration of virtual environment components from XML operations orders